Physics Lesson Plan

BSc 1st Semester- Mechanics

Month	Week	Topics
July	4	Rigid body, Moment of Inertia, Radius of Gyration, Theorems of perpendicular and parallel axis (with proof).
August	1	Moment of Inertia of ring, Disc, Angular Disc, Solid cylinder,
	2	Solid sphere, Hollow sphere, Rectangular plate, Square plate, Solid cone, Triangular plate,
	3	Torque, Rotational Kinetic Energy, Angular momentum, Law of conservation of angular momentum,
	4	Rolling motion, condition for pure rolling, acceleration of body rolling down an inclined plane, Fly wheel, Moment of Inertia of an irregular body. Class Test 1
September	1	Deforming force, Elastic limit, stress, strain and their types, Hooke's law, Modulus of rigidity, Relation between shear angle and angle of twist,elastic energy stored/volume in an elastic body
	2	Elongation produced in heavy rod due to its own weight and elastic potential energy stored in it, Tension in rotating rod, Poisson's ratio and its limiting value,Elastic Constants and their relations. Assignment 1
	3	Torque required for twisting cylinder, Hollow shaft is stiffer than solid one. Bending of beam, bending moment and its magnitude,Flexural rigidity, Geometrical moment of inertia for beam of rectangular cross-section and circular cross-section.
	4	Bending of cantilever (loaded by a weight W at its free end), weight of cantilever uniformly distributed over its entire length. Dispersion of a centrally loaded beam supported at its ends, determination of elastic constants for material of wire by Searle's method. Class test 2
October	1	Michelson's Morley experiment and its outcomes, Postulates of special theory of relativity, relativistic
	2	Relativistic transformation of velocity, relativistic addition of velocities, variation of mass-energy equivalence, Lorentz Transformations, Simultaneity and order of events, Lorentz contraction, Time dilation,
	3	Doppler effect, relativistic kinematics, transformation of energy and momentum, transformation of force, Problems of relativistic dynamics. Mid-term test
November	1	Law of gravitation, Potential and field due to spherical shell and solid sphere. Motion of a particle under central force field, Two body problem and its reduction to one body problemand its solution,
	2	compound pendulum or physical pendulum in form of elliptical lamina and expression of time period, determination of g by means of bar pendulum, Normal coordinates and normal modes, Normal modes of vibration for given spring mass system, Assignment 2
	3	possible angular frequencies of oscillation of two identical simple pendulums of length (l) and small bob of mass (m_0 joined together with spring of spring constant (k).

BSc 3rd Semester- Thermodynamics and Statistical Physics

Month	Week	Topics
July	4	Thermodynamic-systems, variables and equation of state, thermal equilibrium, Zeroth law of thermodynamics; Concept of heat, work and its sign (work done- by the system on the system) & its path dependence.
August	1	First law of thermodynamics- its significance and limitations, internal energy as a state function, different types of process-isochoric process, isobaric process, adiabatic process, isothermal process, cyclic process, Reversible and irreversible process, First law and cyclic process; Second law of thermodynamics and its significance,
	2	Carnot theorem; Absolute scale of temperature, Absolute Zero and magnitude of each division on work scale and perfect gas scale, Joule's free expansion, Joule Thomson effect, Joule-Thomson (Porous plug) experiment, conclusions and explanation
	3	analytical treatment of Joule Thomson effect, Entropy, calculations of entropy of reversible and irreversible process, T-S diagram, entropy of a perfect gas, Nernst heat law (third law of thermodynamics), Class Test 1
	4	Liquefaction of gases, (oxygen, air, hydrogen and helium) solidification of helium below 4K, Cooling by adiabatic demagnetization.
September	1	Derivation of Clausius-Clapeyron and Clausius latent heate quations and their significance, specific heat of saturated vapours, phase diagram and triple point of a substance, development of Maxwell thermodynamical relations,
	2	Thermodynamical functions: Internal energy (U), Helmholtz function (F), Enthalpy (H), Gibbs function (G) and the relations between them, derivation of Maxwell thermodynamical relations from thermodynamical functions
	3	Application of Maxwell relations: relations between two specific heats of gas, Derivation of Clausius-Clapeyron and Clausius equation, variation of intrinsic energy with volume for (i) perfect gas, Assignment 1
	4	(ii) Vander wall gas (iii) solids and liquids, derivation of Stefan's law, adiabatic compression and expansion of gas & deduction of theory of Joule Thomson effect.
October	1	Distribution of N (for N= 2, 3, 4) distinguishable and indistinguishable particles in two boxes of equal size, microstates and macrostates, thermodynamical probability, constraints and accessible states, statistical fluctuations, general distribution of distinguishable particles in compartments of different sizes, β-parameter, entropy and probability
	2	Concept of phase space, division of phase space into cells, postulates of statistical mechanics; Classical and quantum statistics, basic approach to these statistics, Class Test 2
	3	Maxwell-Boltzmann statistics applied to an ideal gas in equilibrium-energy distribution law, Maxwell's distribution ofspeed & velocity (derivation required), mostprobable speed, average and r.m.s. speed, mean energy for Maxwellian distribution
November	1	Dulong and Petit Law, derivation of Dulong and Petit law from classical physics; Need of Quantum statistics- classical versus quantum statistics, Mid term test
	2	Bose-Einstein energy distribution Law, Application of B. E. Statistics to Planck's radiation law, degeneracy and B. E. condensation, Assignment 2
	3	Fermi-Dirac energy distribution Law, F. D. gas and degeneracy, Fermi energy and Fermi temperature; F. D. energy distribution Law for electron gas in metals, zero point energy, average speed (at 0 K) of electron gas

BSc 5th Semester-Modern Physics

Month	Week	Topics
July	4	Need of Quantum Mechanics, Planck's quantum hypothesis and radiation formula, quantization of EM radiation and photoelectric effect, Compton effect, deBroglie hypothesis, de-Broglie wave,
August	1	wave packet,phase and group velocities,Time-dependent and time- independent Schrodinger equations, Properties of wave function, Probability current density,
	2	linear momentum and energy operators, commutator of position and linear momentum operator, expectation values of position and linear momentum,
	3	particle confined in a one-dimensional infinite box: energy eigen functions and eigenvalues, Heisenberg's Uncertainty Principle and its applications. Class Test 1
	4	Crystalline state, crystal lattice, basis, lattice translation vectors, primitive and non-primitive unit cells, symmetry operations,
September	1	Bravais lattices in two and three dimensions, Miller Indices, crystallographic planes, interplanar spacing,
	2	simple crystal structures: NaCl, CsCl,HCP, Zinc blende, Diamond, assignment 1
	3	diffraction of waves by crystals, Bragg's law, Idea of Reciprocal Lattice
	4	Reciprocal lattice to sc,bcc and fcc lattices, non-crystalline solids (introduction only).
October	1	Sommerfeld theory (qualitative), Relativistic correction, Fine structure of Hα line, Lamb shift, Larmor's theorem (qualitative),Vector Atom Model,
	2	electron spin, space quantization, spin-orbit Interaction energy, LS and JJ coupling, Spectral terms for equivalent and non-equivalent electrons, Class Test 2
	3	Anomalous Zeeman effect, Lande's g-factor, splitting of D1 and D2 lines in weak magnetic field, Raman effect, Stoke and Anti-stoke lines.
November	1	Composition of nucleus, stability of nucleus, nuclear properties, nuclear size, spin, parity, magnetic moment, quadrupole moment, Assignment 2
	2	Nuclear Models, Liquid Drop Model and Semiempirical Mass formula, Nuclear shell model and magic numbers (qualitative idea only), Mid term test
	3	classification of fundamental particles, Quark and Lepton quantum numbers, Hadrons, Baryons and Mesons, Different types of interactions and their properties.